NORTH CAROLINA
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT

R. BRUCE ETHERIDGE, DIRECTOR

DIVISION OF MINERAL RESOURCES

Jasper L. Stuckey, State Geologist

Bulletin Number 57

GEOLOGY AND PRELIMINARY ORE DRESSING STUDIES OF THE CAROLINA BARITE BELT

By
E. C. VAN HORN
J. R. LeGRAND and L. L. McMURRAY

Prepared in cooperation with the Tennessee Valley Authority, the South Carolina Research, Planning and Development Board, and the North Carolina State College Minerals Research Laboratory

RALEIGH
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MEMBERS OF THE BOARD OF CONSERVATION AND DEVELOPMENT

LETTER OF TRANSMITTAL

Raleigh, North Carolina

March 7, 1949

To His Excellency, Hon. W. Kerr Scott, Governor of North Carolina.

Sir:

I have the honor to submit herewith, as Bulletin 57, a report "Geology and Preliminary Ore Dressing Studies of the Carolina Barite Belt."

Barite is an important mineral in which there is an increasing interest. This report indicates that the barite deposits of the Carolina barite belt may contain reserves of economic importance. It is hoped that the information presented may be of value to those interested in developing the deposits.

Respectfully submitted,

R. Bruce Etheridge,
Director.

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Geology and Preliminary Ore Dressing Studies of the Carolina Barite Belt

By E. C. Van Horn,[1] J. R. LeGrand,[2] *and* L. L. McMurray[3]

INTRODUCTION

This investigation was a cooperative program of field geology and ore dressing studies set up for the summer of 1947 by the North Carolina Department of Conservation and Development, the South Carolina Research, Planning and Development Board, and the Regional Minerals Section of the TVA Division of Chemical Engineering. The purposes of the program were to determine whether or not the barite deposits of the Carolina belt were of sufficient extent and quality to be of interest to a producing and marketing organization, and to determine what method or methods of beneficiation would be most satisfactory for producing marketable barite concentrates.

All work was under the general direction of Dr. B. F. Buie of the South Carolina Research, Planning and Development Board, Dr. J. L. Stuckey, North Carolina State Geologist, and Mr. H. S. Rankin, Head, Regional Minerals Section, Division of Chemical Engineering, TVA. Messrs. T. G. Murdock, Assistant State Geologist of North Carolina, and C. E. Hunter, Geogolist, TVA, acted in advisory capacities. Earl C. Van Horn, Geologist, TVA, was in charge of work in the field, aided by student assistants, Richard Brasington and Henry Bell, III, of the University of South Carolina, and E. E. Jones of North Carolina State College. Beneficiation work at the North Carolina State College Minerals Research Laboratory was done by J. R. LeGrand, Mining Engineer, under the direction of L. L. McMurray, Chief Engineer.

Location

Barite deposits are situated along a narrow, irregular belt which begins on the northeast slope of Crowder's Mountain, four

[1] Geologist, Tennessee Valley Authority.

[2] Mining Engineer, Minerals Research Laboratory, North Carolina State College.

[3] Chief Engineer, Minerals Research Laboratory, North Carolina State College.

miles east of the town of Kings Mountain, North Carolina, and extends southwestward through the Kings Mountain Parks and the Station of Kings Creek, South Carolina, to near the junction of South Carolina Highways No. 103 and No. 105, about five miles southeast of Gaffney, South Carolina. The belt of barite occurrences lies immediately east of the well known Carolina tin-spodumene belt, and includes part of Gaston and Cleveland Counties, North Carolina, and York and Cherokee Counties, South Carolina.

Past and Present Investigations

Pratt[4] visited the Crowders Mountain locality in 1901, noting briefly the general geology and describing the workings as they appeared at that time. Pratt described the barite as occurring in lenses, seams and "so-called veins" in "micaceous, argillaceous schist." He concluded that "the barytes very probably represents the filling of fissures and crevices in the schist which (the fissures) may have been caused by the faulting and tearing apart of the schist. . . . These lenticular veins may be found to be many hundreds of feet in depth and then connected by a thin seam of barytes to another (lenticular vein)." Associated galena and sphalerite were observed but the presence of calcite was not mentioned.

Probably the most complete study of the Carolina Barite Belt was made by Keith in conjunction with work on the Gaffney-Kings Mountain folio.[5] Keith reported that "The (barite) deposits occur in white, bluish, or mottled quartz-sericite schist. The barite occurs in veins or elongated lenticular masses inclosed in the schist, generally about parallel with the planes of schistosity. The veins worked are generally two feet in width, but smaller veins and seams cut across the bedding in many places around the larger deposits. The veins contain scattered inclusions or sheets of wall rock ranging from a small fraction of an inch to several inches thick. . . . The veins are for the most part in the Battleground schist near the contact with the Bessemer granite, but some are also found in schistose parts of the granite." Mention was not made of the possible origin of the barite.

[4] Pratt, J. H., The Mining Industry in North Carolina During 1901: North Carolina Geol. and Econ. Survey, Econ. Paper No. 6, pp. 62-65, 1902.

[5] Keith, Arthur, U. S. Geol. Survey Geol. Atlas, Gaffney-Kings Mountain folio (No. 222), 1931.

Keith's geologic map shows barite deposits in association with four separate formations: the Bessemer granite, a fine-grained muscovite biotite granite that has been strongly metamorphosed to sericite schist in places, the Battleground schist, a light to dark sericite schist having manganese schist and quartzite phases, the Roan gneiss, chiefly a hornblendic schist or gneiss, and a series of fine-grained diabase dikes. Stuckey investigated the origin of the Carolina barite, and after confirming previous description of the shape, extent, and attitude of the barite masses, he compared them with barite deposits in Virginia.

Stuckey[6] concluded that "Mineralization took place along planes of cleavage through the agency of hot solutions of hypogene origin. . . . The position of the veins with respect to the schistosity of the enclosing rocks makes it appear that they (barite veins) were formed after the last great period of metamorphism which was probably in the late Paleozoic. Mineralization is thought to have been brought about by hot solutions which came up from below and found lines of ingress along the most prominent cleavage planes."

Field work, done during the months of July and August, 1947, consisted of geologic reconnaissance over an area bounded roughly by Shelby, Lincolnton, and Gastonia in North Carolina, and Clover, York, Pacolet, and Cowpens in South Carolina, and of more detailed examinations of some 400 barite occurrences in a belt 24 miles long and two miles wide. Reconnaissance was directed principally toward a search for barite occurrences outside previously known localities, and toward a delimiting of barite occurrences to a specific lithologic unit or series. The work on specific barite deposits involved studies of form, size, quality and lithology of the barite bodies, and collections of samples for use in the laboratory. Barite beneficiation studies were made at the North Carolina State College Minerals Research Laboratory at Asheville, North Carolina. This work included grinding and flotation batch tests on representative material from more than 2,000 pounds of field samples to determine the effect of various types of grinds on barite liberation, the relative effectiveness of various flotation reagents, and the susceptibility of the ores to gravity concentration. All tests were controlled by chemical analyses.

[6] Stuckey, J. L. and Davis, H. T., Barite Deposits of North Carolina: Amer. Inst. Min. Met. Eng., Trans., vol. 115, 1935.

GEOLOGY

Although the time available for areal geologic work on the present study did not permit a thorough evaluation of Keith's geologic mapping and interpretation, the general information set forth in the Gaffney-Kings Mountain folio[7] proved to be satisfactory as a base for additional work. Certain limitations were apparent from the beginning, principally in regard to structural details and to an indistinctness of formational contacts in the field resulting from gradation of lithology and metamorphism. It now seems probable that some of Keith's separate formations are related genetically. In the approach to an evaluation of the barite deposits, however, Keith's geology is utilized with few qualifications.

ROCK FORMATIONS

Bessemer Granite

The Bessemer granite, lying east of the barite zone, is marked by distinctly metamorphic characteristics. In some places the rock has the appearance of a slightly schistose, medium-to-coarse-grained muscovite-biotite granite. More commonly it is a quartz-muscovite-biotite granite gneiss having irregular zones of fine-grained sericite schist and coarse-grained, dark, quartz-mica schist. It is possible that much of the formation represents originally sedimentary rocks which were not digested by the invading granite mass. Small and large quartz veins are distributed throughout the formation, and aplite dikes are common near the eastern limits.

Battleground Schist

The Battleground schist, which lies west of the barite zone, is principally sericite schist and mica schist with colors ranging from white through silver, bluish, and brownish to black. Also contained are quartzose and conglomerate beds, manganese schist, and certain schistose beds of angular fragments which Keith called volcanic tuff. Magnetite is an important constituent of the Battleground schist, and specular hematite may be seen in places, especially at Spears Spring, 1.1 miles southeast of Kings Mountain Pinnacle. An unusual mineral occurrence in

[7] Keith, Arthur, Op. cit.

the Battleground schist is in the barn lot of a house on the southeast side of a dirt road, 0.8 mile northeast of Mount Ararat Church and 6.2 miles ESE of Gaffney, South Carolina. In an outcropping quartz vain, about 15 feet wide and 40 feet long, aggregates of soft, blue pyrophyllite occur as pseudemorphs after kyanite, forming about 10 per cent of the vein material. This occurrence lies very near the barite zone.

Roan Gneiss

The Roan gneiss of Keith's geologic map is associated with the barite zone south of Kings Creek where, according to Keith, the gneiss is injected by the Bessemer granite. In the field it appears more as if the granite had been injected by the Roan gneiss, as narrow zones of fine-to-medium-grained hornblendic schist and feldspathic hornblende gneiss are surrounded by the more prolific granite gneiss and zericite schist of the Bessemer formation. Actually, hornblendic rocks have not been found nearer than about one-half mile from a barite occurrence, and it is doubtful that the two are related in any way since metamorphic structures indicate that the barite is far younger than the hornblendic rocks.

Diabase Dikes

Diabase dikes, up to 20 feet thick, cut across all other formations in the Gaffney-Kings Mountain area. These vertical dikes strike northwest, crossing at right angles the strike trend of older rocks. Probably they occur along fissure-joints which were opened and injected during the Triassic period. Mineralogically the rock seems predominantly olivine, but the texture is so fine that identification of other minerals is problematical. Keith lists labradorite, augite, olivine, magnetite, chlorite, and pyrite.[8] Contact metamorphism of adjacent rocks has not been noted, and the writer doubts that the diabase is related to the barite deposits.

Quartz-Sericite Schist

All known barite deposits of the Carolina Belt are associated with a more or less silicious sericite schist which occurs alternately

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[8] Keith, Arthur, Op. cit.

on either side of Keith's mapped contact of the Bessemer granite and the Battleground schist. The sericite schist is light-colored and fine-to-medium grained. It ranges in outcrop width from a few feet to more than 1,100 feet, and is not present everywhere along the strike. An intense foliation characterizes the schist in all instances, and sharp contacts with other rock types are not seen. Common variations in lithology include dense silicic phases in the vicinity of the Lawton property, east of Kings Mountain, and light-green chlorite schist phases around Kings Creek, South Carolina. In addition, a dense, gray, calcareous schist or micaceous marble has been found on dumps of the main underground workings immediately behind the grinding plant at Kings Creek. It is reported that this rock, which contains many magnetite crystals, was encountered underground as a bedded formation, about 5 feet thick, within the sericite schist. The bed was said to have been discovered where a vein of barite ended abruptly. Similar rock types have not been reported in any of the other workings in the barite belt; neither has the rock been seen in other dumps, or in place.

In those localities where barite has been observed, the quartz-sericite schist exhibits characteristic "filled" appearance, similar to that of fine-grained migmatites, which is not apparent in other sericite schists of the Bessemer granite and the Battleground schist. This "filling" is caused by the presence of particles or clusters of either barite or quartz, or a combination of both, and the condition has been of substantial assistance in recognizing the barite-bearing type of sericite schist. It should be emphasized that barite is contained in the schist only intermittently, as are varying, sometimes great, quantities of quartz. The quartz is most abundant in those localities where barite is not apparent. Other important accessory minerals in the sericite schist include feldspar, muscovite, biotite, chlorite, tourmaline, and magnetite.

STRUCTURE

Keith's folio[9] shows the structure of the area as a complex system of folds, usually overturned toward the northwest. Numerous thrust faults have been inferred by Keith in order to adjust mapped units to a formal time scale. Dips and strikes vary

[9] Keith, Arthur, Op. Cit.

widely from place to place in the area. In the northern portion, near Kings Mountain, the strike is nearly north-south and westerly dips predominate, while in the southern portion, near Gaffney, strikes are more northeast-southwest, and dips are generally southeast. The barite zone has an average strike and dip of N45°E, 60°SE. Actual bedding structures everywhere are subdued by a secondary foliation which constitutes a regional schistosity. Even the most quartzose rocks are affected and any degree of incompetence is emphasized.

Between Crowders Mountain and Kings Creek, minor folds affect only slightly the strike trend of the barite zone from one individual deposit to another, but between Kings Creek and the Lavender property, south of Blacksburg, the barite-bearing sericite schist follows two broad folds which give an initial impression that the barite zone has been offset nearly three miles toward the northwest. Because of deceptive foliation, these broad folds are difficult to trace with any but the most detailed geologic inspection.

Local structures of the barite-bearing schist are similar to those usually found in other metamorphic rocks of the southern Appalachians. Joint systems in the schist are of small apparent importance, since most of the stress has been taken up along planes of foliation. Small faults are not observed readily, but it is reported that faults were of importance in the Kings Creek mines where veins of barite commonly were offset from 2 feet to 10 feet or more. Lineations other than slickensides are faint. Fold axes in barite workings have been measured occasionally, but plunges greater than 10 degrees were not found. At the Kings Creek mines, where exposures were the best, net plunges over a distance of several hundred feet usually were near zero.

BARITE DEPOSITS

Occurrence and Origin

It has been pointed out that the barite occurs only in a zone of quartz-sericite schist which lies near the contact of Keith's Bessemer granite and Battleground schist. Within this zone the barite masses are sub-parallel to major foliation of the locality, although it is not unusual to see large veins cutting across all apparent foliation.

Barite in the Carolina Belt has two forms, one always in association with the other. That form which has received attention in the past is a vein type, either massive-granular or coarsely crystalline, appearing locally as a system of veins which overlap and parallel one another *en echelon* along both strike and dip. Contacts between veins and wall rock are fairly distinct, although fragments of sericite schist are contained in the outer sections of veins. Zoning of mineral content or particle size has not been observed. Vein barite commonly is broken crosswise into blocks ranging from a few inches to the full thickness of the veins, but fractures similar to the foliation of the country rock are not present.

Wall rock which contains vein barite also has small barite particles, or aggregates of particles, ranging in size from microscopic dimensions to an inch or more, disseminated throughout the rock and making up as much as 20 per cent of the mass. It is believed that baritic portions of the schist are lenticular in shape, as are some barite veins, even though the barite content diminishes in directions away from vein concentrations. The disseminated form of barite has not been recognized fully in the past, although it is one of the most important features of the Carolina Barite Belt.

Besides inclusions of sericite schist, the barite contains fine sericite and quartz. Other associated minerals are galena, sphalerite, and calcite in the Crowders Mountain locality, and sulphides of iron and copper in the Kings Creek locality. The Lavender property, south of Blacksburg, shows abundant galena. Tourmaline, magnetite, and pale green chlorite have been found with barite all along the Carolina belt.

The geology of the barite deposits of the Carolina belt is similar to the geology of most other important mineral deposits of the southern Appalachian region. The barite probably is younger than the latest great period of dynamic metamorphism, and it appears to be controlled by fold axes and regional schistosity. It exhibits the same gradational contacts and has the same associations of high or moderate temperature minerals as have most mineral deposits of the region. Core drill holes at Kings Creek have shown barite at depths of at least 250 feet in the same form as surface occurrences. Preliminary studies of thin sections show that the barite replaces quartz and sericite, and that it also occurs as interstital fillings in the sericite schist.

It seems probable that the barite is the result of hydrothermal replacement and emplacement, brought about through the action of ascending solutions at the close of the last great period of metamorphism.

History of Development

Barite deposits have been prospected and mined sporadically in the Kings Mountain-Gaffney area at least since the early 1880's, but production has been an insignificant part of the total United States production. An exact history of the area is not available at this time, but it is believed that the first actual production of barite in the area was from open pits in the Kings Creek deposits of South Carolina. Simultaneously, or at a slightly later date, open pit operations furnished barite from the Lawton property at Crowder's Mountain. By 1900, shaft work was being done at the Lawton property as small veins were worked at depths of 80 feet or more. Around 1923-1924 the Bertha Mineral Company carried on development work consisting of deepening two shafts and driving a connecting drift. High mining cost and low value of the ore apparently were the factors which led to early abandonment of the property. Prior to the later work on the Lawton property, The Cherokee Chemical Company began underground mining of barite at Kings Creek, South Carolina, producing ground barite at a mill constructed at the mine site. This property is now under the name of the Clinchfield Sand and Feldspar Company. During the past ten years, little barite has been produced from the Kings Creek mines, but the grinding plant has operated on barite imported from Tennessee. Indifferent prospecting has been attempted at scattered localities in the Carolina Barite Belt, mostly by individual land owners and tenants who wished to sell crude ore to the local mill, and attention was given only to small quantities of impure surface barite.

Economic Possibilities

Barite in the United States comes from Arkansas, Georgia, Missouri, and Tennessee, and from California, Nevada, North Carolina, and several other states. In 1946, the United States produced around 725,000 tons of barite, and imported some 275,000 tons from Canada and Mexico. The normal price range was from $6.00 to $35.00 per short ton, including both crude and ground barite.

There can be little doubt that flotation concentration is the key to successful development of the Carolina barite, and the ore seems to be naturally adaptable to that sort of processing. Disseminated barite constitutes the base material, with a high-grading effect contributed by large and small barite veins. It is believed that the ore could be removed by quarrying or stripping and that selective mining could be done by site location rather than by a special handling of the ore. Consequently, core drill exploration and sampling of deposits are required before mining and milling programs can be planned. The feasibility of the fundamental technology of floating the barite is reasonably certain. It only remains to prove definite tonnage reserves (by systematic exploration and sampling), to set up marketing arrangements and to make specific designs for a commercial plant. It is possible that an existing plant can be adapted to handle barite production.

MINES AND PROSPECTS

All Healing Springs—Barite appears in two small pits, 2,000 feet apart, in the west bank of a black top road near the old settlement of All Healing Springs, 4.3 miles N88°E of Kings Mountain, North Carolina. The northernmost pit is 4,300 feet N20°E of Crowders Peak, and the southerly pit is 4,000 feet N31°E of Crowders Peak. These locations are shown in Keith's folio.[10] No new barite occurrences have been found near the locality, except for loose fragments which may have come from the existing pits, where veins up to 2 inches thick crop out in sericite schist. It would appear from the map as if the barite zone has a strike of about N20°W, but readings on the foliation average N40°E.

Lawton Property—Most of this property is owned in fee by the Bertha Mineral Company. It is located on the southeast side of Crowders Mountain, 4.3 miles ESE of Kings Mountain in Gaston County, North Carolina. The main barite zone is known to be 2,600 feet long, just crossing over the Bertha Mineral Company property lines at each end. A single additional pit lies about 800 feet farther east of north, so that the north and south extremities of the total known zone are respectively about 3,500 feet S33°E and 5,400 feet S70°E of Crowders Peak. This prop-

[10] Keith, Arthur, Op. cit.

erty is described in the reports of both Pratt[11] and Keith.[12] The barite zone trends N16°E and is fairly regular except at the north end, where either there are two barite horizons, about 400 feet apart, or else a single horizon widens considerably. Here six pits show barite east of the main zone, about 950 feet northeast of the No. 1 shaft.

Barite at the Lawton property first was found as surface float. Some 75 different surface pits were worked by hand, going down until ground water was encountered or until pit walls failed to hold without support. It is probable that the lengths of individual pits or trenches reflect the length of any single lenticular vein having a thickness as much as 4 inches. Pits show an *en echelon* pattern typical of barite lenses observed in other portions of the Carolina Belt. Later work involved the sinking of two shafts, 650 feet apart, to depths of about 200 feet, and the driving of a drift which followed a barite vein or series of veins until the two shafts were connected. It is reported that barite in the drift had an average thickness of 2 feet, and that the average $BaSO_4$ content of the barite was about 87 percent.

All barite concentrates were prepared by hand cobbing the massive vein material. It is reported that attempts were made to jig and table the ore, but without success, and most of the barite seems to have gone on the dumps. It has been estimated roughly that an aggregate of the dumps totals 25,000 tons of material containing 40 percent barite, all capable of being concentrated by flotation to a good commercial barite. Much of the ore would consist of small fragments of vain barite mixed with sericite schist. Disseminated barite in the country rock appears to be sufficient to add materially to the grade of the ore. Associated minerals in the barite include magnetite, tourmaline, galena, sphalerite, sericite, chlorite, quartz, and pink and white calcite. Epidote also is present in more silicic phases of the sericite schist. In preparing a flotation concentrate, it is possible that by-products of sericite, galena, and sphalerite would have some value.

The Lawton property requires a great deal of additional prospecting if the ore is considered for use in a flotation plant. Valuable information could be obtained by cross-cutting the sericite schist zone with a number of trenches in order to determine

[11] Pratt, J. H., Op. cit.
[12] Keith, Arthur, Op. cit.

the extent of baritic schist and the quantity of barite veins. Core drill exploration would be of much greater value, especially if care were used in taking sludge samples in the overburden and if the work were controlled by chemical analysis of the samples.

Craig Property—This property is very nearly an extension of the Lawton property, being one-half mile farther south. It is about 7,500 feet due south of Crowders Peak, and just northeast of a dirt road which connects Mountain View (Phillipsburg) and Trinity Church. Six rather large pits and trenches have been dug in sericite schist along a strip 1,000 feet long and 200 feet wide. The enclosing schist is baritic, and vein barite seems to be of good quality. The pits do not seem to be very deep since dump material does not appear in large quantity. It is entirely possible that deeper prospecting would show additional barite ore, possibly extending northward to the Lawton property and southward to the "Chimney" property.

"Chimney" Place—Approximately 30 pits and trenches show barite for a strike length of about 1,200 feet and a width up to 400 feet. In addition, two pits are situated 1,000 feet farther south, just across a small creek. The property is an extension of the Craig property, being about 2,000 feet farther south, and begins 1,500 feet south of the Mountain View road. Only the pits on the south side of South Crowders Creek are indicated on Keith's map. As in the deposits described above, rock outcrops do not show and information is available only from dumps and from the trends of older works. Most of the pits are less than 10 feet deep, but there is a total of at least 1,000 tons of dump material which could be obtained easily for concentration. A great deal of quartz and sericite and very small amounts of galena may be seen in association with the ore. The quantity of disseminated barite in the sericite schist is not known. Initial prospecting by cross-cutting trenches would allow a more accurate evaluation of the deposits.

Wells Property—For a distance of four miles southwest of the "Chimney" property, barite has not been observed until nearly at the North Carolina-South Carolina state line. Here a barite zone about 1,000 feet long and probably less than 100 feet wide is centered on latitude 81°10′N, 1,200 feet north of the state line and 3,000 feet inside Cleveland County from the Gaston County line. Twelve pits and trenches show at the present time, the deepest ones being about 10 feet deep. The amount of dump material is not large, indicating that extensive work has not been done in the past. This probably was the location that Keith intended to show as location 2 on his geologic map.[13] It is reported that several truck loads of hand cobbed barite were hauled to the Kings Creek, South Carolina plant. Accessory minerals other than quartz and sericite were not observed.

Wyatt Mine—Is is reported that Mr. Emmet Wyatt, of Kings Creek, South Carolina, mined barite from this property on contract and supplied the Kings Creek mill with about two carloads of hand cobbed ore. The property is situated in Kings Mountain State Park, York County, South Carolina, 1.6 miles S65°W from the Cleveland County-Gaston County corner on the North Carolina state line, and 3,800 feet due south of the North Carolina-South Carolina line. Barite was removed from five surface pits, but the largest production was from a shaft about 60 feet deep. Barite on the dumps is more silicious than usual, and the few available outcrops of sericite schist also have a high quartz content.

Piedmont Springs Locality—Barite occurs intermittently for a distance of 1.3 miles along a strip three-fourths mile northwest of Piedmont Springs, in York and Cherokee Counties, South Carolina. Beginning at latitude 81°05'N, longitude 35°25'W, the strip extends nearly due east to the county line and then turns NNE. All the shallow pits seem very old and are overgrown with trees and brush. The southeast end of the strip probably includes the Dan Sanders place which reportedly was prospected by the Cherokee Chemical Company. The dumps contain mostly fine-grained sericite schist, with very little barite showing either as vein or disseminated material.

Kings Creek Locality—The most productive barite zone of the entire Carolina Barite Belt is at Kings Creek, Cherokee County, South Carolina. Pits, trenches, underground workings, and outcrops of vein barite and barite sericite schist are located at close intervals over an area 3,000 feet long and as much as 1,100 feet wide. Specifically, it extends from the railroad siding of the Clinchfield Sand and Feldspar Company's barite grinding plant on the northwest side to 300 feet beyond the southeast end of the Kingsville and Marion Railroad trestle, southeast of

[13] Keith, Arthur, Op. cit.

Kings Creek, and from 300 feet southwest of the large bend in South Carolina Highway No. 5, southwest of Kings Creek, to a line 1,100 feet northeast of the barite mill. One additional prospect, outside this area, lies 0.7 mile northeast of the grinding plant. The strike trend of the baritic sericite schist is N45°E.

One reason for the extensive work on barite at Kings Creek is that overburden generally is not deep and barite crops out at the surface in many places. These conditions encouraged original surface mining and additional barite was discovered as the surface working became more numerous and were transformed to entries for underground mining. In the later stages of intensive development, about twenty core holes were drilled in search of larger veins. Most of these core holes were drilled on the up-dip side of the richer barite horizons, and were usually two shallow to be of much value. Core records have not been preserved, but it is reported that one hole intercepted a 2-foot barite vein at a depth of 250 feet. Parts of this core were examined by the writer and found to be similar in all respects to surface barite. Cores showing disseminated barite in sericite schist were not available.

The Kings Creek locality has more than 200 individual prospect and mine openings, parts or all of which are still accessible for inspection at the entries. Many of the openings are too small to have significance in regard to past production, although they are of value in appraising the extent of barite mineralization. Of these many openings, the bulk of the Kings Creek barite production in the past has come from five main groups. Except for scavanger work, none of the separate groups were in production simultaneously, but each was begun when the previous group had been abandoned.

The Big Incline was the second largest producer and the first mine worked. It is situated immediately behind (southeast of) the grinding plant. The work started as a surface stripping operation on a hill which sloped toward a small stream. It is reported that a sheet-like barite vein, from 2 to 6 feet thick, lay on the dip slope of the hill under 8 feet of overburden for a strike distance of more than 100 feet. After this surface barite had been removed, the small stream was diverted through a flume so that inclines could be started southeast along the dip of the vein. The underground work ultimately reached a depth of about 200 feet along a 30 degree slope, with lateral workings supported by ore pillars. All these openings are now flooded.

A second group of workings, located about 1,000 feet northeast of the grinding plant, include a number of individual surface pits and inclined drifts over an area of about one acre. The barite occurred as veins from 4 inches to 4 feet thick, in several different horizons, with dips averaging less than 30 degrees toward the southeast. Aggregate production was the greatest of any of the five groups.

The West Hill Mine is a combination open-cut and underground mine situated 700 feet southwest of the grinding plant. The general outline of the working is elliptical, with maximum dimensions 250 feet long by 90 feet wide. A series of barite veins were encountered, the main one being at least 8 feet thick. Average dip was nearly zero and the veins had a 10 degree plunge to the northeast. It is probable that the ore occurs on or near the crest of an anticline or on the bench of a monocline. Initial work seems to have been done in an open cut, and underground mining was done later when several entries were made into the side of the hill. Hand cobbed barite was delivered to the grinding plant by truck.

The Old Highway Mine lies at the southwest end of the barite zone, southwest of the large curve on Highway No. 5, 1,800 feet southwest of the grinding plant. A small incline leads into a low room where sheet mining has followed a 15-inch barite vein over a width of about 35 feet and a length of probably 150 feet. The vein, which has an average dip approaching zero, plunges 10-15 degrees northeast in the forepart of the mine but the plunge diminishes to near zero at the northeast end. At the southeast side of the underground working, the vein seems to begin dipping southeast, and an outcrop at the surface indicates a 30 degree dip within 15 feet of the mined portion. Wall rocks contain many small veins as well as disseminated barite.

The most recent work at Kings Creek centered 800 feet slightly south of east from the grinding plant. Inclined drifts followed barite veins which were reported to be as much as 12 feet thick. All of these workings are now flooded and are not accessible for inspection.

Reasons for the abandonment of each working are obscure. In some instances the mines were flooded and attempts were not made to resume operations. Work was halted in other places when the veins thinned out appreciably. The key to mine abandonment possibly lies in the fact that mining has been done by individuals on contract, payments being made on a tonnage basis. Naturally the easiest mining was done first and a great deal of time was spent in reworking dump material. It seems that wide variations of grade were allowed, as the $BaSO_4$ content of the ground barite ranged from 65 percent to 90 percent, but even this incentive was not enough to keep the mines going.

Barite reserves at Kings Creek are more readily estimated than at any other locality in the Carolina Belt, but additional prospecting will have to be done before any degree of accuracy can be applied. Rough estimates indicate that the Kings Creek locality has at least 30,000 cubic yards of ore in easily accessible dumps, representing a $BaSO_4$ content of possibly 30,000 tons. Reserves in place should exceed 400,000 tons of ore containing a total of 33 percent $BaSO_4$. These estimates take into consideration the disseminated barite contained in sericite schist wall rock. The above figures should be taken as indicative only. Possibly by-products from the Kings Creek ore would include sericite, galena, and quartz.

The barite grinding plant at Kings Creek has a capacity of about 2 tons per hour. Primary crushing is done in a hand-fed jaw crusher, and is followed by secondary crushing in a single set of rolls. The barite passes through a direct oil-fired rotary dryer and is fed to a Raymond roll mill which is in closed circuit with an air separator. Bagging is done through an open tube which has a sheet cut-off.

John Childers Place—Fragments of barite have been found in the residuum of a sericite schist on the west side of Bells Branch, 0.9 mile N80°E from New Hopewell Church and 1.0 mile N50°E of Jefferson Mountain, Cherokee County, South Carolina, on the estate of the late John Childers. No signs of prospecting were observed.

Lavender Place—Barite occurs on what might be called Ninety Nine Island Creek, in Cherokee County, South Carolina, 1.1 miles N49° W of Ninety Nine Island School, 8.2 miles east of Gaffney, South Carolina. Mineral rights are under lease to Mr. C. W. Watkins, Route 5, Hendersonville, North Carolina. It is reported that about five cars of barite was removed from an inclined drift in the northeast bank of the creek. No other openings have been made at the locality. The mine dumps contain an estimated 250 tons of baritic rock, and the mine opening has been refilled with waste material, possibly during a period of hand-sorting from the dump. The barite is relatively free from quartz, but galena is present in quantities such that it might be a valuable by-product if the property is exploited in the future.

Frank Earl Property—Mr. Frank Earl now owns and occupies this property which lies immediately southwest of the Lavender property, on the northeast side of a paved road leading to Ninety Nine Island Dam. Narrow trenches and inclined drifts have been opened along a zone of sericite schist which probably is less than 50 feet thick. The main barite vein apparently was about two feet thick. It is reported that this material was used in the glass industry, but there is no information as to the amount of barite produced.

Martin Place—Fragments of barite were found near a three-foot pit on the Martin place, 1.3 miles west of Ninety Nine Island School. No other indications of barite appear in the vicinity.

Sams Place—A string of eight small pits is located in the south side of London Creek, 2.8 miles east of Draytonville School. Outcrops indicate that the sericite schist is only a few feet thick and that it contains more disseminated quartz than barite. Vein type barite contains more quartz than at any other locality observed in the Carolina Belt. All workings on the Sams place seem to have been made for prospecting alone, and it is doubtful that much barite has been shipped from the property.

Mt. Ararat Church Locality—The southernmost barite occurrence observed in the Carolina Belt is 50 feet north of South Carolina Highway No. 3, 0.7 mile west of Mt. Ararat Church, and 1.6 road miles southeast of Draytonville School. Blocks of rather pure barite may be found around a shallow depression in a pine thicket. It is reported that several carloads of barite were extracted from an open cut, but present appearances do not reflect an operation of that size.

LABORATORY INVESTIGATIONS

The following laboratory report is an appraisal of the ore dressing aspects of barite ores occurring in the Carolina Barite Belt of North and South Carolina. It was prepared as a supplement to the field investigation, and as an aid in the evaluation of the deposits.

IDENTIFICATION AND ANALYSIS OF SAMPLES

Sample Number	Location and Description
254- 1	West Hill Mine, Kings Creek, South Carolina. Channel sample of main orebody. Vein barite more than three inches thick and badly stained material not included. Barite-quartz-sericite schist. Barite occurs in lens-shaped masses from upwards of three inches thick, grading down to very thin streaks. The barite is of high quality, free from contained rock, and predominatly light colored. Contains an estimated 45 percent barite. Quartz occurs in lenses similar to the barite. The schist is in bands surrounding the barite and quartz.
254- 2	Same as Sample 254-1, except taken from badly stained area. Barite is iron stained.
264	Predominantly sericite schist low in barite. Barite megascopically unobservable. Moderate amount of iron staining.
286-12	Dump of Shaft No. 1, Lawton property.
286-13	Composite from upper dumps NE of creek and SW of Shaft No. 1, Lawton property.
286-14	Composite from intermediate dumps NE of creek and SW of Shaft No. 1, Lawton property.
286-15	Composite from lower dumps NE of creek and SW of Shaft No. 1, Lawton property.
286-16	Composite from dump of Shaft No. 2 and dumps immediately SW of creek, Lawton property.
286-17	Composite from dumps on top of hill SW of creek, Lawton property.
286-18	Dump of Old Highway Mine, Kings Creek, South Carolina.
286-19	Dump of West Hill Mine, Kings Creek, South Carolina.

Samples 286-12 through 286-19 varied from medium weathered and slightly stained to highly weathered and highly stained.

Sample Number	$BaSO_4$	SiO_2	Fe_2O_3	Al_2O_3	R_2O_3
254- 1	43.2	49.0	0.27	4.73	....
254- 2	44.5	48.7	0.47	3.63	....
264	5.5	71.1	1.4	....	....
286-12	60.3	27.5	....	....	7.5
286-13	37.8	41.5	....	....	14.6
286-14	51.0	29.6	....	....	12.1
286-15	58.6	30.0	....	....	7.8
286-16	36.8	45.8	....	....	10.4
286-17	23.5	47.7	....	....	18.7
286-18	31.8	54.0	....	....	9.3
286-19	30.8	55.9	....	....	8.6

CONCENTRATION

A preliminary inspection indicated that flotation concentration appeared to be the only concentration method applicable. From observing the ore and making rough separations of the lumps by specific gravity, it appeared that a possibility for coarse concentration existed to a limited extent. Roughly 15 percent to 20 percent of the ore could be rejected as tails without appreciable loss of barite. An insufficient quantity of ore was available to make jigging or tabling tests to estimate the pre-flotation rejection which could be made.

On an ore which was prepared by mixing sample 254-1 and 264 in a ratio of 3 to 1, there appeared a distinct possibility of rejecting up to 50 percent of the feed which would be low in barite.

In order to prepare a high quality concentrate, flotation is required, probably even on jig concentrates, due to the lack of liberation at sizes above 10 mesh.

Since samples 286-12 through 286-19 are dump samples, the results herein presented are indicative only to the recovery that could be expected when using barite from old dumps, overburden, or from highly weathered rock. In order to prevent excessive sliming, these samples were ground to a 150 mesh minimum size before flotation.

Samples 286-12 through 286-17 were deslimed on 325 mesh between primary crushing and rod-milling. However, from experience gained, it is believed that this is not necessary for the less weathered samples. In test No. 17 on sample 254-1 a pebble mill grind was used to avoid iron contamination in grinding. All other tests utilized a rod mill.

Initial studies were made to determine the point of liberation and the effect of various grinds on the flotation results. Grinds with the following screen analysis were used in tests on samples 254-1, 254-2, and 264.

Minus 28 Mesh Grind

Screen	Concentrate Percent Weight	Middlings Percent Weight	Tailings Percent Weight
+ 28	0.0	0.0	0.0
+ 60	0.5	0.8	0.1
+100	10.7	9.4	6.3
+200	38.3	20.8	20.3
+325	13.7	9.7	21.3
—325	36.8	59.3	51.8

Minus 150 Mesh Grind

Screen	Concentrate Percent Weight	Middlings Percent Weight	Tailings Percent Weight
+150	0.0	0.0	0.0
+200	14.7	6.7	24.6
+325	18.2	15.5	30.0
—325	67.1	77.8	45.4

97 Percent Minus 325 Mesh

Screen	Concentrate Percent Weight	Middlings Percent Weight	Tailings Percent Weight
+200	0.0	0.0	1.5
+325	1.3	2.2	4.5
—325	98.7	97.8	94.0

The flotation results on Samples 254-1, 254-2, 3 to 1 mixture of 254-1 and 264, and samples 286-12 through 286-19 are shown as follows:

Sample No. 254-1 Minus 28 Mesh Grind (Test No. 17)

Feed: 600 gms—8 Mesh ore ground 1 minute at 35 percent solids in pebble mill with 1.0 lb./T sodium meta-silicate.

Procedure: Feed transferred direct to cell and conditioned 30 seconds at 20 percent solids with reagents (1) below. Floated 2 minutes. Machine discharge conditioned 30 seconds with reagents (2) below and floated 3 minutes. Froth cleaned 3 times with cleaner reagents (3) below.

Reagents:
(1) 0.15 lb./T Amyl Kanthate
0.17 lb./T Aero-float 31
1.0 lb./T Sodium meta-silicate (in grind).
(2) 0.77 lb./T Oleic acid
0.17 lb./T Pine oil
(3) Cleaner—1.0 lb./T Sodium meta-silicate in each cleaner.

Results:

Product	Percent Weight	Specific Gravity	Percent $BaSO_4$	Percent Fe_2O_3	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
FP-1 sulphides	6.5	......	......	......	......	......
Barite conc.	41.4	4.41	94.8	0.04	89.0	94.8
Middlings 1, 2 & 3	8.8	3.19	33.3	0.24	......	......
Tailings	43.3	2.78	5.7	......	......	......

Sample No. 254-1 Minus 150 Mesh Grind (Test No. 22)

Feed: 600 gms—8 Mesh ore ground 10 minutes at 35 percent solids in rod mill with 1.0 lb./T sodium silicate.

Procedure: As Test No. 17 except omitted sulphide float and used following reagents. Cleaned froth 2 times.

Reagents: (2) 0.61 lb./T Oleic acid
0.17 lb./T Pine oil
1.0 lb./T Sodium meta-silicate (in grind)

Results:

Product	Percent Weight	Percent $BaSO_4$	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
Barite concentrate	45.2	96.1	91.7	94.7
Middlings 1 & 2	26.0	5.8	......	......
Tailings	28.8	9.0	......	......

Sample No. 254-1 Minus 28 Mesh Grind (Test No. 25)

Feed: As Test No. 22, except ground 1½ minutes in rod mill.

Procedure: As Test No. 22, except used following reagents.

Reagents: (1) 1.0 lb./T Sodium meta-silicate (in grind)
(2) 0.84 lb./T Oleic acid
1.0 lb./T Sodium meta-silicate
0.17 lb./T Pine oil
(3) 1.0 lb./T Sodium meta-silicate in each cleaner.

Results:

Product	Percent Weight	Percent $BaSO_4$	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
Barite concentrate	42.6	94.0	91.0	96.1
Middlings 1 & 2	11.9	20.1	......	......
Tailings	45.4	3.8	......	......

Sample No. 254-2 Minus 150 Mesh Grind (Test No. 24)

Feed: As Test No. 22

Procedure: As Test No. 22, except used the following reagents.

Reagents: (1) 1.0 lb./T Sodium meta-silicate (in grind)
(2) 0.77 lb./T Oleic acid
1.0 lb./T Sodium meta-silicate
0.17 lb./T Pine oil
(3) Cleaner—1.0 lb./T Sodium meta-silicate in each cleaner.

Results:

Product	Percent Weight	Percent $BaSO_4$	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
Barite concentrate	44.4	95.7	94.8	98.0
Middlings 1 & 2	22.4	7.4	......	......
Tailings	33.3	2.6	......	......

Samples No. 254-1 and No. 264 (3 to 1 mixture. Contains a calculated 34.2% $BaSO_4$) Minus 28 Mesh Grind (Test No. 29)
Feed: As Test No. 25

Procedure: As Test No. 22, except used following reagents.

Reagents:
(1) 1.0 lb./T Sodium meta-silicate (in grind)
(2) 0.61 lb./T Oleic acid
1.0 lb./T Sodium meta-silicate
0.17 lb./T Pine oil
(3) 1.0 lb./T Sodium meta-silicate in each cleaner.

Results:

Product	Percent Weight	Percent $BaSO_4$	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
Barite concentrate	35.9	94.3	88.6	96.0
Middlings 1 & 2	9.6	30.9	.....	.....
Tailings	54.5	2.9	.....	.....

Samples No. 254-1 and No. 264 (3 to 1 mixture) Minus 28 Mesh Grind (Test No. 30)

Feed: As Test No. 25

Procedure: As Test No. 22, except for reagents listed below

Reagents:
(1) 1.0 lb./T Sodium meta-silicate (in grind)
(2) 0.46 lb./T Oleic acid
1.0 lb./T Sodium meta-silicate
0.17 lb./T Pine oil
(3) 1.0 lb./T Sodium meta-silicate in each cleaner.

Results:

Product	Percent Weight	Percent $BaSO_4$	Percent $BaSO_4$ Recovery	Calculated Plant Recovery
Barite concentrate	32.2	96.3	83.0	96.3
Middlings 1 & 2	11.7	45.0	.....	.....
Tailings	55.9	2.6	.....	.....

One of the main objectives was to produce a product that would meet specifications for most of the commercial users. In this connection, tests were run on the various ores to reduce the iron content of the concentrate as much as possible.

The following results were obtained:

Test No.	Sample	Type Iron Removal	Type Grind	Percent Fe_2O_3 Concentrate
17	254-1	Sulphide float	Pebble mill	0.04
27	254-1	None	Pebble mill	0.08
28	254-2	None	Pebble mill	0.19
29	Mixed 254-1 & 264	None	Rod mill	0.10

Samples 286-12 through 286-19

The test procedure for these samples differs from the above only in samples 286-12 through 286-17 were deslimed on 325 mesh before rod-milling, and the minimum rod mill grind was 150 mesh. Samples 286-18 and 286-19 were not deslimed before rod-milling.

The slime loss and percent $BaSO_4$ loss in the slimes for samples 286-12 through 286-17 are given below:

Sample Number	Percent—325 slime	Total percent $BaSO_4$ lost in slime
286-12	12.5	3.3
286-13	15.8	5.8
286-14	24.5	11.0
286-15	18.0	8.6
286-16	17.1	8.1
286-17	24.5	10.6

	Product	Mesh of Grind	Percent Weight	Percent $BaSO_4$	Percent Recovery	Calculated Plant Recovery Percent
Sample 286-12	Concentrate	20	53.2	97.4	85.8	88.9
	Middlings	....	6.8	45.1	......	......
Test No. 4	Tailings	....	25.8	5.9	......	......
	Slime	....	14.2	16.2	......	......
	Concentrate	65	56.4	98.6	92.1	93.2
	Middlings	....	3.5	31.7	......	......
Test No. 6	Tailings	....	25.8	3.6	......	......
	Slime	....	14.3	16.2	......	......
	Concentrate	150	54.1	97.9	87.9	90.5
	Middlings	....	4.3	31.6	......	......
Test No. 7	Tailings	....	26.8	3.9	......	......
	Slime	....	14.8	16.2	......	......
Sample 286-13	Concentrate	20	29.9	98.4	78.0	83.9
	Middlings	....	8.6	68.5	......	......
Test No. 8	Tailings	....	40.6	2.8	......	......
	Slime	....	20.9	14.0	......	......
	Concentrate	65	30.2	99.0	79.6	86.3
	Middlings	....	9.1	74.1	......	......
Test No. 9	Tailings	....	38.9	3.3	......	......
	Slime	....	21.8	14.0	......	......
	Concentrate	150	34.4	98.3	89.4	91.1
	Middlings	....	7.1	24.0	......	......
Test No. 10	Tailings	....	40.7	3.5	......	......
	Slime	....	18.5	14.0	......	......
Sample 286-14	Concentrate	20	45.1	98.6	89.9	95.5
	Middlings	....	2.5	47.9	......	......
Test No. 12	Tailings	....	23.3	4.3	......	......
	Slime	....	30.1	22.9	......	......
	Concentrate	65	38.5	99.4	75.5	84.9
	Middlings	....	6.2	74.3	......	......
Test No. 13	Tailings	....	25.6	6.9	......	......
	Slime	....	29.7	22.9	......	......
	Concentrate	150	44.7	99.1	86.9	90.8
	Middlings	....	3.7	45.5	......	......
Test No. 14	Tailings	....	24.2	5.9	......	......
	Slime	....	17.4	22.9	......	......
Sample 286-15	Concentrate	20	53.6	98.2	89.9	92.5
	Middlings	....	2.5	60.9	......	......
Test No. 15	Tailings	....	24.4	2.7	......	......
	Slime	....	19.5	28.1	......	......

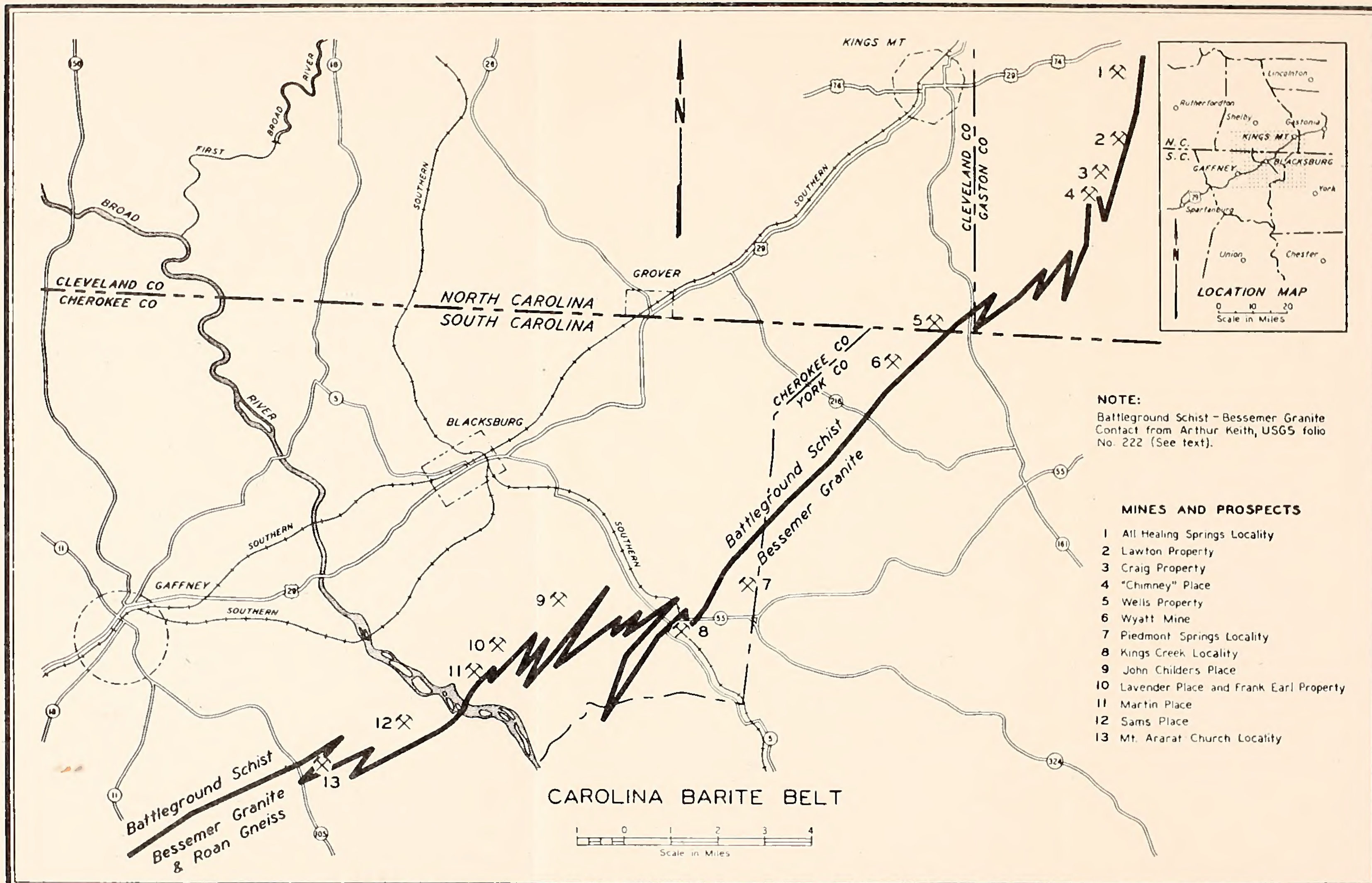
	Product	Mesh of Grind	Percent Weight	Percent $BaSO_4$	Percent Recovery	Calculated Plant Recovery Percent
	Concentrate	65	52.8	98.9	88.8	91.8
	Middlings	....	2.0	45.4	......	......
Test No. 16	Tailings	....	25.2	2.8	......	......
	Slime	....	20.0	28.1	......	......
	Concentrate	150	51.9	98.4	86.9	89.7
	Middlings	....	3.9	43.4	......	......
Test No. 17	Tailings	....	24.8	3.8	......	......
	Slime	....	19.4	......	......	......
Sample 286-16	Concentrate	20	29.3	95.9	76.2	91.9
	Middlings	....	8.4	68.9	......	......
Test No. 18	Tailings	....	47.7	4.6	......	......
	Slime	....	14.6	17.4	......	......
	Concentrate	65	34.1	95.2	88.6	92.1
	Middlings	....	4.9	28.5	......	......
Test No. 19A	Tailings	....	46.6	2.1	......	......
	Slime	....	14.4	17.4	......	......
	Concentrate	150	32.2	96.8	84.7	92.0
	Middlings	....	6.8	40.7	......	......
Test No. 20	Tailings	....	47.8	2.7	......	......
	Slime	....	13.2	17.4	......	......
Sample 286-17	Concentrate	20	22.6	95.9	88.1	89.0
	Middlings	....	5.4	37.4	......	......
Test No. 21	Tailings	....	48.7	1.7	......	......
	Slime	....	23.3	10.1	......	......
	Concentrate	65	24.9	95.6	83.0	88.0
	Middlings	....	5.4	37.8	......	......
Test No. 22	Tailings	....	48.9	2.0	......	......
	Slime	....	20.8	10.1	......	......
	Concentrate	150	23.1	97.0	82.1	87.9
	Middlings	....	6.8	23.6	......	......
Test No. 23	Tailings	....	49.3	2.4	......	......
	Slime	....	20.8	10.1	......	......
Sample 286-18	Concentrate	20	30.4	94.4	90.1	92.8
	Middlings	....	4.2	20.7	......	......
Test No. 24	Tailings	....	65.4	3.5	......	......
	Concentrate	65	28.3	97.6	86.9	93.7
Test No. 25A	Middlings	....	7.9	28.9	......	......
	Tailings	....	63.8	3.6	......	......
	Concentrate	150	28.9	97.8	88.9	95.0
Test No. 26	Middlings	....	7.8	27.6	......	......
	Tailings	....	63.3	2.7	......	......
Sample 286-19	Concentrate	20	30.1	94.8	87.1	95.9
	Middlings	....	7.6	39.4	......	......
Test No. 27	Tailings	....	62.3	2.2	......	......
	Concentrate	65	30.4	97.8	90.8	94.5
Test No. 28A	Middlings	....	8.0	14.9	......	......
	Tailings	....	61.6	2.9	......	......
	Concentrate	150	29.5	95.2	90.4	93.0
Test No. 29	Middlings	....	6.5	14.6	......	......
	Tailings	....	64.0	3.3	......	......

CONCLUSIONS

The laboratory tests indicate that the barite is essentially freed from the gangue minerals at a relatively coarse size, roughly minus 20 mesh for flotation separation. However, since the ore is readily ground, and most trades specify a much finer mesh product, it would seem economical to make this size reduction before flotation, thereby confining the grinding to one unit and taking advantage of the finer size in flotation separation.

Concentrates of a good white color were made from some of the less stained ores, but other concentrates contained varying amount of iron stain. It would be necessary to leach the concentrates from the stained ores to meet the more rigid specifications of some trades. The expected plant recovery can be said to be above 90 percent by flotation. Iron analysis as low as 0.04 percent Fe_2O_3 has been obtained by grinding the ore in a pebble mill to avoid iron contamination.

The feasibility of the fundamental technology of concentration of the disseminated barite by flotation is reasonably certain. Before mining and milling progress can be planned core drilling exploration and additional sampling are required. It was not the purpose of the present investigation to prove adequate tonnage for commercial development, but to point the way for further investigations which may lead to economic utilization of the deposits. It is believed that the ore could be removed by quarrying or stripping and selective mining could be done by site location rather than by special handling of the ore.



CAROLINA BARITE BELT